APPENDIX:

The Appendix includes the following item:

- copy of UK Patent 1406817

PATENT SPECIFICATION

(11) 1406817

1406817

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D1D 2G5C 2G5E 2G5X

(19)

(54) WINDING APPARATUS

(71) We, MASCHINENFABRIK RIETER A.G., a body corporate organised under the laws of Switzerland, of Winterthur, Switzerland,

do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to a winding apparatus arranged automatically to change wound packages and provided with means for compensating thread tension variations during the package change. Such devices are used particularly in the spin-draw-winding process in the man-made fibre industry, in which process continuity of the thread take-up from the spinnerets must be maintained, and waste thread generated during the change from a full package to an empty tube should be kept to a minimum.

Winding apparatus is already known in which an automatic package change device automatically transferring the thread ensures continuity of the thread take-up. In these known devices, two package tubes are provided each being arranged on a chunk on a rotatable and movable arm. These arms alternately press the winding packages against a friction drive drum transferring the thread delivered by the thread traversing device to the winding package. During the package change, the movable supporting arm is pivoted and is moved in such manner that, for a short time, the full package as well as the empty package tube contact the friction drive drum so that the empty package tube is accelerated while the full package is still driven. For transferring the thread to the empty package tube, the supporting arm is pivoted further and is lifted off the friction drive drum so that this package is slowed down. During the thread transfer time span, however short, during which the full package is not driven any more and the empty tube takes up the transferred thread in reserve windings for which the thread is not traversed, the thread tension can deviate for a short moment; this results in a different thread quality during this moment, or the thread tension can drop to zero, so that the danger of lap formation and of defective thread transfer arises.

According to the invention, there is provided a winding apparatus comprising a friction drive drum for driving two package tubes which can alternately be brought into contact with the friction drive drum, chucks on which package tubes can be placed, a rotatable and fixable support arm on which the chunks are arranged, the arm being rotatable into a position for replacing the full package and into a position in which a package tube can contact the friction drive drum, a thread deflecting device for compensating for thread tension variations during the package change, the thread deflecting device being mounted on a movable support, and means for generating a force which is applied to the support.

The movable support can be a lever arm supported pivotably about a pivoting axis with means for generating a rotational moment in the lever, or a sliding element displaceable along a guide. The means for generating a rotational moment preferably consists of at least two means which complement each other in dependence on the position of the lever arm.

In the accompany drawings:

Fig. 1 is a side view of a winding apparatus provided with a lever arm for compensating the thread tension variations during a thread winding process,

Fig. 2 is a lever arm provided with two thread deflecting means, and

Figures 3 to 21 illustrate further alternative design examples of means for compensating the thread tension variations.

As illustrated in Fig. 1, a support table 3 is slidably supported by parallel rods 1 and 2 rigidly connected to a frame and supports a shaft 4 on which is arranged an arm 5 provided with two chucks 6 and 7. The arm 5 is pivotable counterclockwise. During the winding process a fixing pin 8 prevents the

[*Price 33p*]

pivoting movement of the arm 5 and releases the arm 5 for the packing change. A package 9 is driven by a friction drive drum 10 which it contacts. A thread traversing guide 11 of a traversing device 12 guides a thread 13 which is taken up by the friction drive drum 10 and transferred to the package 9. A frame 14 supports a lever arm 16 on a pivoting axle 15, the lever arm 16 being provided with a thread deflecting means 17 and a movable weight 18. A roll 19 transfers the thread 13 to a roll 20. The thread tension of the thread 13 running off the roll 20 and onto the friction drum 10 is kept constant by means of the lever arm 16.

The package change is effected by releasing the arm 5 by the fixing pin 8 and moving the table 3 towards the right, the arm 5 simultaneously being pivoted counterclockwise about the axle 4 by suitable means (not shown), until in addition to the full package 9 a tube 22 placed on to the chuck 7 is also driven by the friction drive drum. As the arm 5 is pivoted further counterclockwise, the full package 9 is lifted off the friction drive drum 10 towards the left, the table 3 being moved to the left and the full package 9 being rotated further only by its rotational momentum. As the arm 5 is pivoted still further until the fixing pin 8 is again effective on the side of the full package 9, *i.e.* in the winding position of the empty package, the thread 13 bypassing the traversing device 12 is transferred by suitable catching means from the full package 9 to the empty tube 22, on which empty tube upon taking up a number of parallel wraps and upon re-insertion of the thread 13 into the traversing device 12 the normal winding process is carried on, as described e.g. in the Specification of our British Patent No. 1,332,182.

The thread tension variations caused by the thread transfer are compensated by the lever arm 16 (Fig. 1) provided with the means generating a rotational moment, *e.g.* provided with a thread deflecting device 17 and with a weight 18. The weight 18 is shifted on the lever arm 16 until the lever arm position corresponds to the thread tension and to the desired pivoting range of the lever arm 16.

Fig. 2 illustrates a lever arm 21 with a fixed pivoting axle 22 and provided with two thread deflecting devices 23 and 24, with a weight 27 and with a thread deflecting device 26 rigidly connected to a machine frame (not shown). The double deflection serves the purpose of forming a larger thread reserve between the roll 20 and the friction drive drum 10.

In Figures 3 to 15, alternative design examples of the means generating a rotational moment for compensating the thread tension variations are shown schematically. In these alternative design examples the means generating a rotational moment are subdivided in two or more mutually assisting means, either by increasing or prolonging respectively, step by step or continuously the forces and/or the lever arm distances of the means as the lever arm is increasingly pivoted in the direction of pivoting corresponding to the direction of the thread tension. In this manner an increasingly adapted action of the means generating a rotational momentum can be effected as desired, so that increasing thread tensions can be compensated.

Fig. 3 illustrates the frame 14 with a lever arm 27 pivotably supported on an axle 28, a thread deflecting device 29, a weight 30 shiftably arranged on the lever arm 27, connected by a cable 33 with a weight 34 loosely placed on the platform 35. Under normal thread tension conditions, the lever arm 27 pivots within the range in which the weight 30 generating a rotational moment is effective. If the lever arm 27 is pivoted considerably counterclockwise due to a sharp increase in tension in the thread 13, the cable 33 is tensioned and the weight 34 is lifted off the platform 35.

In this manner, the rotational moment acting on to the lever arm 27 is increased by this amount and counteracts the additional thread tension.

Fig. 4 illustrates an alternative design example to the one shown in Fig. 3. In that arrangement, a weight 31 is slidably arranged on the lever arm 27 independently of slidable element 32 also arranged on the lever arm 27 and connected with the cable 33.

Fig. 5 illustrates a cross-section of the lever arm 27 with a weight 31 and a slidable element 32 with a cable 33.

Fig. 6 illustrates the frame 14 with a lever arm 36 pivotably arranged on a pivoting axle 37 with a thread deflecting device 38, a cylindrical cable drum 39 connected to the lever arm 36. A cable 40 is wrapped on the drum 39. A weight 41 is suspended from the cable 40 and is connected by another cable 42 with a weight 43 loosely placed on a platform 44.

Under normal thread tension conditions in this arrangement also, only the weight 41 is effective as a means of generating a rotational moment. If the thread tension increases sharply, the lever arm 36 again is pivoted far down so that the cable 42 is tensioned and the weight 43 is lifted. The rotational moment acting on the lever arm 36 is thus increased by this amount.

In Fig. 7 the frame 14 is shown with a lever arm 45 pivotably arranged on a pivoting axle 46, with a thread deflecting device 47 and with a cable drum 48 connected with the lever arm 45, which drum 48 is connected to a weight 50.

Within the range of normal thread tensions the upper cylindrical portion of the drum 48 (which has a radius r) is effective as a lever arm length of the rotational moment to be

generated together with the weight 50. If the lever arm 45 pivots further counterclockwise the cable 49 is taken up by the curved element 51 the effective lever arm length generating the rotational moment thus being increased to a maximum length *a*. The rotational momentum acting on the lever arm 45 can thus be increased without the use of an additional weight.

Fig. 8 illustrates the frame 14 with a lever arm 52 pivotably arranged on a pivoting axle 53, a thread deflecting device 54 and a cable drum 55 connected with the lever arm 52. The drum 55 is connected by a cable 56 to a weight 57.

In contrast to the cable drum 51 shown in Fig. 7, the cable drum 55 is provided with a curve of variable radius (also effective within the normal range of thread tensions) indicated by the distances $b1$, $b2$, $b3$ and $b4$ resulting between the rotational axis and the tangential contacting point of the cable 56, where $b1<b2<b3<b4$. In this manner also, a decrease of the rotational moment can be effected as the thread tension decreases or as the lever arm 52 increasingly pivots clockwise, or *vice versa*.

Fig. 9 shows the frame 14 with a lever arm 59 pivotably arranged on a fixed pivoting axle 60, a thread deflecting device 61, a spiral spring 62 having an outer end connected to a pin 63 and an inner end connected to lever arm 59, another spiral spring 64 having an inner end connected to the lever arm 59 and the outer end provided with a hook 65. The spring 62 overcomes the influence of the lever arm 50 with the thread deflecting device 61 and also generates the rotational moment compensating the thread tension within the normal range of thread tensions. If the thread tension increases strongly and if, therefore, the lever arm 59 is strongly pivoted counterclockwise. The hook 65 of the spring 64 the inner end of which is also connected with the lever arm 59 takes hold on the pin 63 so that the additional rotational moment generated by the action of the spring 64 counteracts the increased thread tension.

In Fig. 10, a lever arm 67 is pivotably arranged on a pivoting axle 66 provided with a thread deflecting device 68, the weight of the arm is balanced by a weight 69 slidably arranged on the lever arm 67. The inner end of a spiral spring 70 is connected with the lever arm 67 and the outer end is connected with the pin 71. The spring 70 and the weight 69 generates the rotational moment needed within the normal range of thread tensions. Strong increases in thread tension are compensated by the rotational moment generated additional by the spiral spring 72, the inner end of which also is connected to the lever arm 67, after the hook 73 has taken hold on the pin 71.

Fig. 11 illustrates the frame 14 with a lever arm 74 pivotably arranged on a fixed pivoting axle 75. The arm 74 is provided with a thread deflecting device 76. A cable drum 77 is connected with the lever arm 74. A tension spring 78 has a lower end connected *via* a platform 79, with the frame 14 an upper end connected, *via* a cable 80, with the cable drum 77. Another tension spring 81 has an upper end connected via a platform 82 with the frame 14 and a lower end connected via a string 83, with the drum 77. The tension springs 78 and 81 respectively have the same function as the spiral springs 62 and 64 respectively shown in Fig. 9. The cable 83 hangs loosely below the capstan 77 in this arrangement and after further counterclockwise pivoting of the lever arm 74, caused by strong increases in thread tension, tightly contacts the drum 77 and tensions the tension spring 81.

Fig. 12 illustrates an alternative arrangement to the one shown in Fig. 11. In this arrangement, only the tension spring with the cable 80 acts on the drum 77.

Fig. 13 illustrates the frame 14 with the platforms 79 and 82, a lever arm 84 pivotably arranged on a pivoting axle 85, a thread deflecting device 86, a cable drum 87 connected with the lever arm 84, and tension springs 90 and 91 respectively. One end of each spring is connected with the platform 79 and 82 and the other end spring is connected by cables 88 and 89 respectively with the drum 87.

The tension springs 90 and 91 have essentially the same function as the springs 78 and 81 shown in Fig. 11. The cable drum 87 on the other hand has an analogous function to the one of the drum 55 shown in Fig. 8, *i.e.* owing to the variable radius indicated by the distances C1, C2, C3 and C4 between the rotation axis and the tangential contacting point of the cables 88 and 89 respectively the rotational moment is varied in the same sense as described with reference to Fig. 8, where C1<C2<C3<C4.

The use of a curved cam disc in this arrangement offers the possibility of compensating or adjusting the spring characteristics and thus of controlling the characteristics of the rotational moment.

Fig. 14 illustrates a cable drum 92 connected with the lever arm 84. A cable 93 is wrapped on the drum 92 and is connected to a weight 94. The other characteristics of this arrangement are the same as shown in Fig. 13. Th drum 92 has essentially the same function as the one shown in Fig. 13. The characteristics of the rotational moment of the lever arm 84 within the range of normal thread tensions are determined by the weight 94 as well as the right half of the drum 92 and in the range of strongly increasing thread tensions additionally is determined by the

spring 91 as well as the left half of the drum 92.

For the arrangements according to Figures 11, 12, 13 and 14 the additional possibility also exists (as described with reference to Fig. 10) that the corresponding lever arms 74 and 84 can be longer and that the lever arm with the thread deflecting device is provided with a slidable weight corresponding to the weight 69 for balancing the weights of the lever arm and the thread deflecting device. Also, the drums are not limited to the shapes illustrated, all curves suitable for controlling the characteristics of the rotational moment being feasible.

Fig. 15 illustrates a frame 95 with guide rails 96 guiding a slidable element 98 connected with one end of a tension spring 99, the other end of the spring being connected to the frame 95. The element 98 supports an axle 97 on which a capstan 100 is rotatably arranged. A lever arm 101 provided with a thread deflecting device 102 is rigidly connected with the drum. A weight 104 is suspended from a cable 103 which is wrapped around the drum 100.

Fig. 16 illustrates the thread being transferred from draw rolls 19 and 20 to a thread deflecting device 105. The thread deflecting device 105 is supported by a sliding element 106, which is slidably arranged on the guide rails 107 of the frame 108. A weight 110 suspended from a cable 109 connected to the element 106 tends to move the element 106 upward against the action of the thread tension acting on the thread deflecting device 106. At the upper part of the frame 108 the string 109 is deflected by means of a roll 111.

Fig. 17 illustrates the thread 13 being transferred from draw rolls 19 and 20 to two thread deflecting devices 112 and 113 rigidly mounted on the frame and to a thread deflecting device supported by a sliding element 116. The sliding element 116 is slidably arranged on the guide rails 114 of the frame 115. A weight 117 is suspended from a cable 109 connected to the sliding element 116.

Figures 18 to 21 illustrates alternative means of creating a force opposing the thread tension. Fig. 18 shows a weight 118 suspended from a cable 109, when weight 118 taking care of the tension of thread 13 within the normal range of thread tensions, and a second weight 119 being placed on a rigid support and connected *via* a cable 120 with the weight 118. The second weight 119 is lifted off the support only if the thread deflecting device is pulled into the range of a strongly increasing thread tension, *i.e.* is pulled towards the lever end of the guide rails.

Fig. 19 illustrates a tension spring 121, one end of which is connected with the cable 109 and the other end of which is connected with a rigid support, spring 121 taking care of the tension of the thread 13.

Fig. 20 illustrates a tension spring 122 one end of which is connected with the cable 109 and the other of which is connected with a weight 123 placed on a rigid support. The tension spring 122 takes care of the tension of the thread 13 within the range of normal thread tension. As the thread tension increases strongly, the weight 123 is lifted off by the tensioned spring 122.

Fig. 21 illustrates a tension spring 124 is shown one end of which is connected a spring 125 and the other end with the cable 109 and in turn is connected with a rigid support and is substantially expanded if the thread tension strongly increases.

The apparatus is not limited to the downward thread path which is illustrated. In an arrangement in which the winding elements are located above the drawing elements such as draw rolls, *etc.*, the thread path would extend upwardly, and if the lever arm is placed at an angle or if the position of the guide rails is altered, any lateral direction of the thread path is possible.

Furthermore, the clockwise pivoting action of the lever arm can be secured against overpivoting to the side of negative action by means of a fixed or elastic stop.

The advantages of the apparatus illustrated for compensating thread tension are:

a) simple and thus economically advantageous manufacture;

b) fast and problem-free function in operation.

WHAT WE CLAIM IS:—

1. A winding apparatus comprising a friction drive drum for driving two package tubes which can alternately be brought into contact with the friction drive drum, chucks on which package tubes can be placed, a rotatable and fixable support arm on which the chucks are arranged, the arm being rotatable into a position for replacing the full package and into a position in which a package tube can contact the friction drive drum, a thread deflecting device for compensating for thread tension variations during the package change, the thread deflecting device being mounted on a movable support, and means for generating a force which is applied to the support.

2. An apparatus according to Claim 1, wherein the support comprises a lever arm supported on a frame and the means for generating a force applies a rotational moment to the lever arm, the lever arm being pivotably mounted on a pivot axle.

3. An apparatus according to Claim 2, wherein the pivot axle is rigidly arranged on the frame.

4. An apparatus according to Claim 2,

wherein the pivot axle is slidable in the frame.

5. An apparatus according to Claim 4, wherein the pivot axle is supported in a slidable element.

6. An apparatus according to Claim 5, wherein the sliding element is suspended from a tension spring connected to the frame.

7. An apparatus according to Claim 2, wherein the means generating a rotational moment consist of at least two means which complement each other in dependence on the position of the lever arm.

8. An apparatus according to claim 2, wherein the means for generating a rotational momentum is so arranged that the moment it applies to the arm differs according to the position of the lever arm.

9. An apparatus according to claim 2, wherein the means for generating a rotational moment is a weight acting on the lever arm.

10. An apparatus according to claim 9, wherein the weight is slidable on the lever arm.

11. An apparatus according to claim 9, wherein a further weight placed on a platform and liftable according to the lever arm position is connected with the weight.

12. An apparatus according to claim 9, wherein a further weight placed on a platform and liftable according to the position of the lever arm is connected by a cable with an element slidable independently of the weight on the lever arm.

13. An apparatus according to claim 2, wherein the means generating a rotational moment comprise a means of generating a force acting on a cable drum connected with the arm.

14. An apparatus according to claim 13, wherein the means of generating a force comprise a weight suspended from a cable wrapped around the cable drum.

15. An apparatus according to claim 14 wherein the means of generating a force comprise a further weight placed on a platform and liftable according to the lever arm position, the further weight being connected with the weight via a cable.

16. An apparatus according to claim 13, wherein the means of generating a force is a tension spring one end of which is connected to the frame and the other end of which is connected to a cable wrapped around the cable drum.

17. An apparatus according to claim 13 wherein the means of generating a force are two springs one end of each being connected to the frame and the other end of each being connected to a cable wrapped around the cable drum.

18. An apparatus according to claim 13, wherein the means of generating a force are a weight and a spring, the weight being suspended from a cable wrapped around the cable drum and the spring being connected at one end to the frame and on the other end with a cable wrapped around the cable drum.

19. An apparatus according to claim 13, wherein the periphery of the cable drum is circular.

20. An apparatus according to claim 13 wherein the periphery of the cable drum is divided into a zone of constant radius and into a zone of a radius increasing to a desired maximum.

21. An apparatus according to claim 13, wherein the periphery of the cable drum is divided into a zone over which the radius increases and into a zone over which the radius increases on an appreciably greater rate up to a maximum.

22. An apparatus according to claim 2, wherein the means for generating a rotational moment comprise a spiral spring the inner end of which is connected with the lever arm and the outer end of which is connected with the frame.

23. An apparatus according to claim 22, wherein the means for generating a rotational moment comprise a second spiral spring the inner end of which is connected with the lever arm and the outer end of which is so positioned as to contact the frame after a given pivoting movement of the lever arm.

24. An apparatus according to claim 2 wherein the lever arm is itself balanced with respect to its own weight.

25. An apparatus according to claim 1, wherein the movable support comprises an element slideably movable on a fixed guide rail.

26. An apparatus according to claim 25, wherein the sliding element is connected with the force generating means by a cable.

27. An apparatus according to claim 26, wherein the cable passes over a deflecting roll.

28. An apparatus according to claim 25, wherein the force generating means comprises a plurality of means which assist one another according to the position of the sliding element.

29. An apparatus according to claim 25, wherein the force applied by the force generating means differs according to the position of the sliding element.

30. An apparatus according to claim 29, wherein the force applied by the force generating means increases as the thread tension also increases.

31. An apparatus according to claim 26, wherein the force generating means comprises a weight suspended from a cable.

32. An apparatus according to claim 31, wherein the force generating means comprises a further weight placed on a rigid support and connected *via* a cable with the weight suspended from the cable.

33. An apparatus according to claim 26, wherein the force generating means are a spring one end of which is connected with the cable and the other end of which is connected with a fixed point.

34. An apparatus according to claim 26, wherein the force generating means are a spring and a weight, the spring being connected on one end with the cable and on the other end being connected with a weight placed on a rigid support.

35. An apparatus according to claim 26, wherein the force generating means are two springs connected together at one end, one spring being connected on its other end with the cable and the other spring being connected at its other end to a fixed point.

36. A winding apparatus substantially as described herein with reference to the accompanying drawings.

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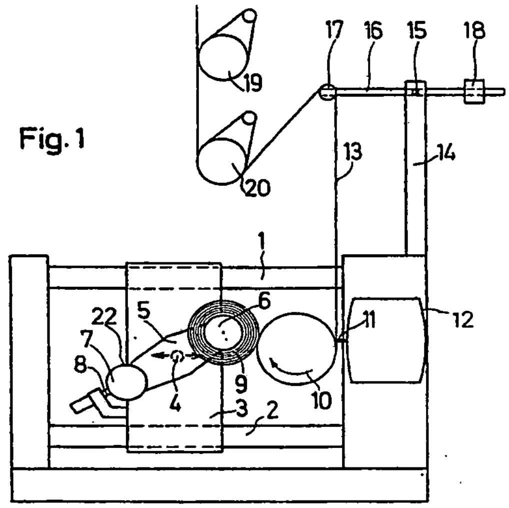

Fig. 1

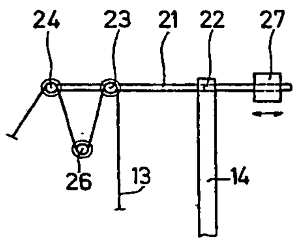

Fig. 2

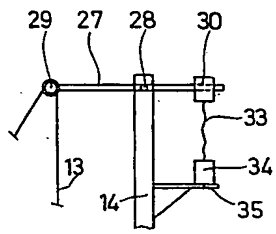

Fig.3

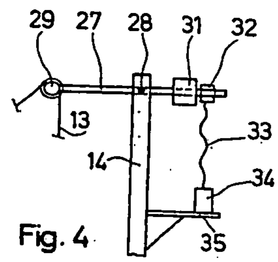

Fig. 4

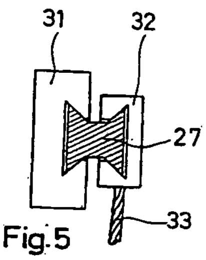

Fig. 5

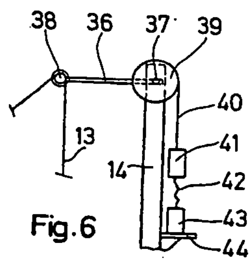

Fig. 6

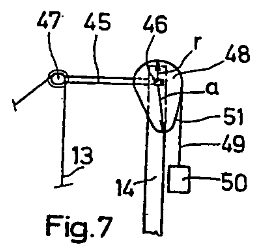

Fig. 7

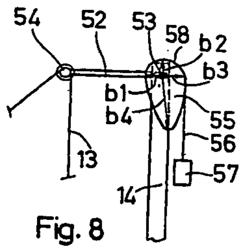

Fig. 8

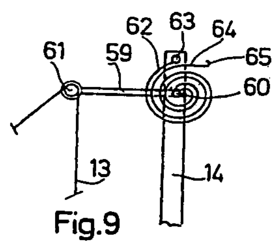

Fig. 9

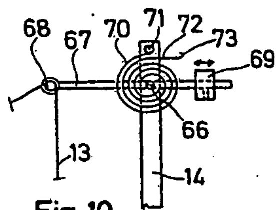

Fig. 10

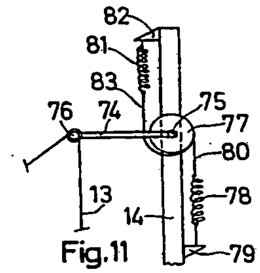

Fig. 11

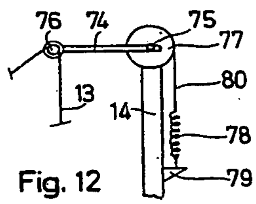

Fig. 12

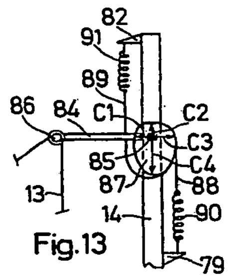

Fig. 13

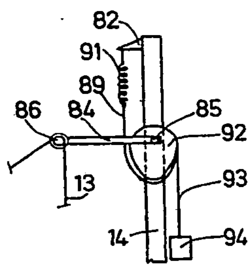

Fig. 14

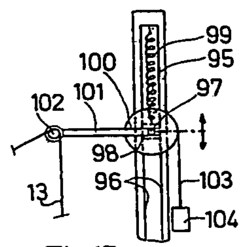

Fig. 15

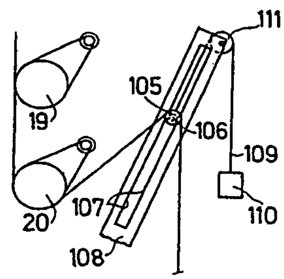
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Fig. 16

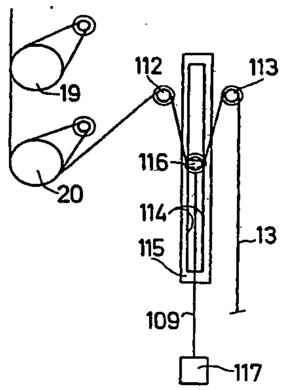
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Fig. 17

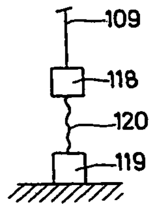

Fig. 18

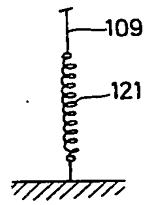

Fig. 19

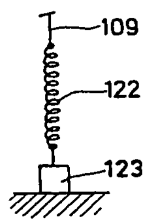

Fig. 20

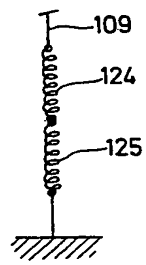

Fig. 21